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THE DISTRIBUTION OF TIME.

From time to time during the last twenty years there have appeared articles in the public prints which indicated an awakening and growing interest in the practicability of having wide sections of our country transact its business and govern its social duties by a common time. Within the last few years official reports from various observatories, departments of the Government, scientific societies, and the telegraph companies, have shown so considerable a progress in the introduction of uniform systems of time, and these systems have been so cordially received by the communities interested, that there can be no doubt that the country is ready to be divided into a few great sections, each of which shall be governed by its own standard, which shall bear some simple relation to the standards governing the neighboring sections.

The principal systems now in operation comprise the United States Naval Observatory system, which extends its distribution of Washington time to Chicago and the West; the Harvard and Yale systems, which distribute, respectively, Boston and New York time over New England; the Alleghany Observatory system, which is concerned chiefly with the Pennsylvania Railroad; and the more local services emanating from the observatories at Albany, Chicago, Cincinnati, and St. Louis. Unfortunately, except in New England, the distribution of the time of an observatory has not always resulted in the adoption of that time for general use, and it is often the case that the local jewelers who are the guardians of town-clocks, and local time as well, will convert the time received by telegraph into their own local time, and thus make it inconveniently different from the time in use in any other city of their region.

A railroad may or may not secure the adoption of its own time in the cities along its route. It is generally a question as to which is the most important, the railroad or the town. But certain it is that there is not an important railroad in the country, outside of New

England, along which the commercial traveler may go without having to compute the discrepancy between his watch and the time kept by the business men at one half the stopping-places. Thus it happens that, even where cities are closely connected by large railroads, the people have been dictated to by their jewelers regarding their standard of time, when a little reflection shows that there is only a very questionable advantage arising from having a local time simply because the jewelers of the city insist on a time which shall appeal to the local pride of their customers.

On the other hand, the disadvantage of having the factory operatives begin work on railroad time and stop on local time, because they gain ten minutes a day by that sharp practice ; the jostle and inconvenience in the commercial interchange between two neighboring cities, because the stock-exchanges, business offices and the banks, close with a difference of ten minutes ; the thousand engagements broken by the discrepancies of time—all indicate the need of the adoption of such a common time as already exists in the European countries.

The writer has always felt that the railroads ought to be the most influential means in securing uniformity. They can be successfully appealed to for the financial support which any accurate system demands, because they have a direct and strong interest in the use of the same time at every office and by every employee of their roads. The superintendents, too, with whom the decision of such matters generally rests, are keenly alive to anything which lessens the risk of accident, and they at once appreciate the advantage of having the clocks of intersecting roads, and of the towns through which their roads pass, all indicate the same time. The control of a telegraph wire for railroad business gives them the means of transmitting time-signals, and in New England it is the railroads which have virtually caused the all but universal acceptance of the Boston and New York standards referred to. Outside of New England there has been scarcely any concert of action among the railroads, and there are about seventy different standards of time in use. The result of the experiment in New England fairly justifies the belief that, were the railroads in the rest of the United States approached on this question, they would combine to adopt the standards of time now used by a few of the great centers of population. Thus, while it was found quite impossible to unite the New England roads upon Boston time, and while it would have been equally impossible to cause the Boston roads to run on New York time, it has proved highly satisfactory to allow the current of travel, which always drifts toward the nearest center of population, to decide the matter. To bring into use in a large section of the country two standards, where before there has been a dozen, is the first step toward uniting the two into one ; and, in the writer's opinion, it is only by a gradual amalgamation of different local times that the final adoption of a few standards for the whole country can be effected. As a rule, railway corporations are more intelligent on this subject than the town councils which are elected by popular suffrage. They are also urged to encourage uniform time by their own interests. They are under the direct influence of State legislation, and the agreement of a number of railroads can be made to influence the communities of the regions traversed to use the railroad standard. Whether the pressure of State legislation ought to be used is an open question. It has been the writer's experience that the railroads are quite willing to do their part without recourse to any such means ; and with the average railroad official the fact that a service is to be enforced by legislation prejudices him against it.

The difficulties in the way of introducing a new standard would still further be reduced if the observatories universally took care to distribute a time which should be as accurate as human art could make it, and use only such simple means of rendering it available as could allow of no vitiation of the message over the time-telegraph wires. By so doing the observatories would, so to speak, have a monopoly of the best article in the market, for no private jewelers could hope to furnish the local time with the precision obtained in a first-class observatory, where every means is taken to insure accuracy. There is, however, little use in trying to supplant a local time which is furnished by a respectable jeweler who takes good care of a good clock, and who has acquired the art of determining his time carefully, if the new system of signals is not to be relied upon within a single second. Unfortunately, the example set the time-services of the country, by that under the direction of the Naval Observatory at Washington, is not of the best; and, until it is realized by the proper officers that a division of responsibility in the charge of delivering time-messages results in the inaccuracy of the service to the public, the services organized under the control of universities will occupy the first place for accuracy.

The best, because the most unmistakable in its indications, of the means yet proposed for the distribution of a public time consists in the ordinary telegraph receiving-instrument, which is brought into circuit with the observatory clock at stated intervals. The clock then automatically beats in such a manner as to indicate the beginning of the minute, or of the five minutes, which have been agreed upon for the reception of the time by telegraph.

Experience has shown that the average railroad employee or telegraph operator very quickly apprehends this method of transmission, and, since the clock effects the distribution automatically, if the signals are received at all they must be exact. The very tempting method of propelling the hands of clocks by electricity has never been successfully applied over extended areas; and the nearest approach to an accurate service from a distant observatory takes place when the pendulum of the clock at a distance from the observatory is moving in sympathy with the observatory clock, through the action of induced electrical currents. A very good example of this kind may be seen in the Treasury clock, at Washington, where one of the Observatory clocks controls it, beat by beat, through the intervention of a mile of telegraph-wire. In this system, which is commonly known as Jones's system, the interruption of the telegraphic circuit, by storms or otherwise, does not cause the controlled clock to stop, as in the systems above referred to; but one can never be sure, when the current is restored, that the controlled clock will not have deviated during the stoppage of its control; and this method has not proved successful where high accuracy is demanded, or the telegraph lines are liable to such interruptions as are common in our climate. This method, however, has found considerable favor in England, and the writer had little difficulty in using a clock, so controlled, at the end of a well-protected wire four miles distant from the Observatory of Harvard College. It was not, however, perfectly reliable, and errors of from two to ten seconds were sometimes found to exist in the controlled clock.

Of the new method, which originated, we believe, in Vienna, and has made its way as far westward as Paris, of setting clocks by means of pneumatic tubes, there can be a great deal said on the score of economy, when the system is applied to large cities. It certainly would be a popular idea to have the time laid on, as the water or gas is, from a small pipe passing the door. The special clock needed would be furnished and kept in order by the payment of a small annual rental. The expense would be trifling as compared with any system yet suggested of equal accuracy, and the field is so promising that it would be strange if attempts were not soon made in our large cities to occupy it. But such or any similar systems for the local distribution of time will depend upon the accurate and regular reception of the standard from an observatory which may be several hundred miles distant; and for this principal service, as well as for the railroads, the writer has already expressed the opinion that the transmitting and receiving apparatus of the telegraph companies, in connection with an observatory clock, affords the best, as well as the simplest, means.

So much for the public distribution for commercial and social purposes. There is another and extremely important service, too much neglected in our country, in behalf of the merchant marine. The Royal Observatory at Greenwich justly considers the accurate dropping of the time-balls on the English coast of almost equal importance with the transmission of time over England. A similar service should be undertaken by our own Naval Observatory, and the suggestions embodied in Professor Holden's report to the Secretary of the Navy,* on this subject, receive the cordial support not only of the officers of the navy and of the merchant marine, but of those men of science whose attention has been called to the lack of such a service at the important ports of Philadelphia, Baltimore, and San Francisco.

Such a service is performed for the port of New York, though not with the assurance of accuracy we have a right to expect in such a Government work. The Observatory of Harvard College, in connection with the United States Army Signal Service, drops a time-ball for the benefit of Boston Harbor, and perhaps there is no one public signal of the Harvard Time Service which is received with more public favor than this, not only by the commanders of vessels lying in the harbor, but by the people living on the surrounding highlands, and numerous factories and institutions from which the signal is visible. This signal owes its existence to the public spirit shown by the Equitable Life Insurance Company, of New York, in erecting the apparatus necessary upon the top of their magnificent building. The time-balls in Boston, New York, and Washington, have thoroughly ingratiated themselves in the public favor.

The cost of the construction of a time-ball of the best materials and of sufficient size, with the electrical apparatus necessary, is about a thousand dollars, and, although it is the most accurate signal for popular use, yet the time-gun has many advantages, on the score of economy and convenience, over the more exact time-ball. The time-gun could be extemporized from one of a battery, at any place where there is a detachment of the artillery service permanently located. Of course, there is an error owing to the time required for the sound to traverse the distance from the gun to the hearer, but this is insignificant for ordinary purposes, and it is not necessary to take any other trouble than to merely listen for the report of the gun which is known to be discharged by an electrical current from some observatory at an arbitrary instant. The time-guns have shown themselves to be very popular in Great Britain and on the Continent; and if our army, either through its Signal Service or the artillery, could act in concert with observatories in different parts of the country, the discipline necessary for the efficient performance of such a service would be obtained, and the service would be extremely popular among the people.

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* Report of the Secretary of the Navy, second session, Forty-fourth Congress.

Doubtless the Naval Observatory could assist in distributing the time to the whole country, but there are several reasons why it would be inexpedient for many years to come. That observatory has a legitimate sphere in fostering astronomical science throughout the country, and in performing such services as are directly for the benefit of the navy and other Government offices.

There are several observatories, particularly in our Western cities, which rely for a large share of their hold of the popular sympathy upon the public time-signals which they furnish. So long as they are strongly interested in the growth of their local service, they will do missionary work for science by interesting the people in the observatory which gives them their time.

Now, let these communities be approached through the offices of the telegraph companies acting as the agents of the Naval Observatory, and the majority will at once feel, with some truth, that the matter is no longer one of science and the patronage of a local or State institution, but that the telegraph companies are urging for their own profit the introduction of a service for which the people have not sufficient need to pay the price charged. In support of this view it might be mentioned that under date of April 2, 1877, our most prominent Telegraph Company issued an official circular through the agency of its principal local offices throughout the United States, which urged the importance of accurate time, and made financial proposals to furnish the Naval Observatory time to seventy-eight cities of the United States once a day, at a charge varying from seventy-five to five hundred dollars per year for each place. So far as the writer knows, there has not been a single acceptance of these proposals, and even one or two acceptances might be considered exceptions to a rule. Another difficulty is the cost of the service to cities which are far distant from the distributing office. The telegraph companies justly claim that this service ought to be paid for at a higher rate than ordinary business messages because it is preferential, and all other business must cease at a given time. This arbitrary stoppage may sometimes prove highly inconvenient, and presupposes a thoroughness of discipline among employees which it is difficult to maintain over the long lines of our Western country. The service to be popular must be quick to redress grievances, and accommodating in the details of its work, particularly at its initiation. It is evident that these agencies are best insured by having the friendship toward the observatory of an important class in the community somewhat dependent on the efficiency of its time-service.

The furnishing of correct time is educational in its nature, for it inculcates in the masses a certain precision in doing the daily work of life which conduces, perhaps, to a sounder morality ; and this idea will not seem far-fetched if we consider how strikingly indicative of the character of a people in the scale of civilization is the promptness with which they transact their business. It is felt, therefore—and particularly in New England—that the university does a creditable action when it directly encourages the distribution of time from its observatory. This view will be adopted by the Western institutions of learning as they gradually rise to the dignity of having distinct observatories connected with them.

At the last meeting of the American Association for the Advancement of Science, in Boston, a committee was appointed to urge the adoption of uniform systems in various parts of the country. This committee includes the representatives of the observatories which have done most in this cause.

The American Metrological Society, through a committee, have presented a carefully prepared report on the present condition of this question in the United States.* It is the opinion of that committee that the standards of time for the various parts of the country should differ by even hours, beginning with the meridian which is just four hours west of Greenwich, and designating the systems as in the last column of the following table :

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* "Proceedings of the Metrological Society," vol. ii. New York : Published by the Society.

PROPOSED SCHEDULE OF STANDARDS OF TIME.

GEOGRAPHICAL SECTION.	STANDARD MERIDIAN.	TIME SLOWER THAN GREENWICH.	DESIGNATION.
Newfoundland.......... New Brunswick......... Nova Scotia, etc.........	60° west.	4 h. 0 min. 0 sec.	Eastern time.
Canada .... Atlantic States.......... Ohio to Alabama........ Lower Lakes...........	75° "	5 h. 0 min. 0 sec.	Atlantic time.
Mississippi Valley....... Missouri............... Upper Lakes........... Texas..................	90° "	6 h. 0 min. 0 sec.	Valley time.
Rocky Mountain region.....	105° "	7 h. 0 min. 0 sec.	Mountain time.
Pacific Slope............ British Columbia........ Vancouver's Island......	120° "	8 h. 0 min. 0 sec.	Pacific time.

The constitution of both of these committees is such that they would favor the distribution of standards of time according to any such scheme as the preceding rather than the distribution of a single time from the Naval Observatory. The above scheme, in the opinion of those who have given most thought to the subject, is the best one so far presented. It was due originally to Professor Benjamin Peirce, and its great merit consists in there being no greater difference than half an hour in any part of the country between the true local time and the arbitrary standard—an amount but slightly greater than exists between Greenwich and the west of England. In passing from the Ohio into the Mississippi Valley, for instance, the traveler merely changes his watch by one hour ; and the merchant, remembering that Pacific time is three hours slow of Atlantic time, knows that it is half-past two in San Francisco when it is half-past five in New York.

Any scheme which proposes the adoption of a uniform time from one extremity of the country to the other must be looked upon as chimerical for a century to come. Ten o'clock in the morning at once conveys to our minds an idea of the average occupation of our people at that time ; it is associated with a certain brightness of daylight ; it means that the working-classes have been occupied with their daily task about three hours ; we expect to find the majority of banks and shops open ; and any disturbance of these traditional times would be received with marked disfavor. To learn, for instance, from the morning paper that a distinguished public man had arrived in San Francisco late in the evening, and, fatigued with his journey, had retired at seven o'clock, would give the Eastern reader a sense of the utter strangeness of keeping a time three hours different from local time.

Any action for the establishment of standards of time over the country must begin by securing the active coöperation of the telegraph companies. The most influential of these companies has been traditionally public-spirited in allowing the use of its wires for scientific purposes, often at considerable expense to itself. The service of transmitting time occupies at present such an extremely small proportion of its ordinary business that the company has not as yet an officer of its service empowered to carry out the details necessary for such time-distributions as have been already discussed. If, however, the committees referred to could prepare a scheme that was thoroughly practical, and agree upon a uniformity of details which should not seriously interfere with the ordinary business of this or any other company, it is believed that the company would find it to their own interest to establish a regular system of procedure to govern their action in the case of observatories in different parts of the country which desire to secure their services in transmitting time-signals. In consideration of the assumption of responsibility and the efforts at introduction made by the observatory, the company would probably be found willing to so adjust their charges that it would prove to be entirely practicable for the various observatories to secure a large patronage for the services emanating from them without the financial burden seeming an undue amount.

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